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a form-giving casting die body, made of a material of high heat conductivity, having at least one broad side wall having at least one surface, a part of which defines a meniscus, the casting die body having a pouring side and a cooling-surface side, which cooling surface side is in contact with a bath

wherein the casting die body has a cooling zone in thermally and mechanically stressed areas of the die body, the mold surface in said cooling zone having a rate of heat flow 5-40% greater than that in the remainder of the surface of the casting die providing increased cooling rate in the critically stressed areas of the casting die.

REMARKS

Claims 1-7, 9-12, 14 and 15 are pending in the application and stand rejected for various formal and substantive reasons. In view of the foregoing amendments and the discussion that follows, Applicants respectfully submit that the application is in condition for allowance.

1. Formal Objections are Overcome

Claim 1 has been amended to overcome a formal objection. No new matter has been added. Entry of amendment and withdrawal of the formal objections are requested.

2. Claims are Patentable over Grove in view of Hargassner

Claims 1, 6-7 and 9-12 stand rejected as allegedly unpatentable over U.S. Patent No. 5,927,378 to Grove et al. ("Grove") in view of U.S. Patent No. 5,117,895 to Hargassner et al. ("Hargassner"). For at least the reasons that follow, Applicants respectfully request reconsideration and withdrawal of this rejection.

The references, even if combined, fail to disclose each and every feature of independent claim 1. Claim 1, as amended herein to overcome formal objection, recites in part:

wherein the casting die body has a cooling zone in thermally and mechanically stressed areas of the die body, the mold surface in said cooling zone having a rate of heat flow 5-40% greater than that in the remainder of the surface of the casting die providing increased cooling rate in the critically stressed areas of the casting die.

(Emphasis added.)

The Examiner agrees that Grove does not disclose or suggest this feature (see Office Action at page 4, line 3), but alleges that Hargassner cures this deficiency. Indeed, Hargassner does not disclose or suggest this feature. Instead, at col. 1, lines 51-59, Hargassner discloses that:

In accordance with the invention, this object is achieved in that the width of the cooling ribs is smaller than, or equal to, 13 mm and that the flow speed of the coolant is adjusted such that the heat transmission coefficient α between the internal plate and the coolant is between 20 and 70 kW/m²K, preferably between 25 and 50 kW/m²K, such that the heat flow density for the internal plate is larger than the heat flow density for a smooth internal plate having no ribs.

Hence, the reference is alleging that if the cooling coefficient (α) is maintained between 20 and 70, then the heat flow density of the internal plate would be larger than the heat flow density of a smooth internal plate having no ribs.² Thus, the reference teaches providing a constant cooling coefficient rate to the internal plate. Applicants respectfully submit that maintaining the value of the cooling coefficient rate (α) at a constant value in

² At col. 1, lines 28-29, the reference discloses that ribs are areas between the cooling channels.

a range of 20 - 70 kW/m²K is not the same as providing the claimed ratio of 5-40%.

For at least this reason, Applicants respectfully submit that the references, even if combined, fail to disclose or suggest the claimed invention as claimed in claim 1.

Claims 6-7 and 9-12 depend from claim 1 and are deemed patentable at least by the virtue of their dependence from claim 1, which as stated is patentable over the cited references. For this reason, additional reasons for patentability for each of claims 6-7 and 9-12 will not be proffered here.

For at least these reasons, Applicants respectfully request reconsideration and withdrawal of this rejection and submit that the claims are in condition for allowance.

3. Claims are Patentable Over Villanueva in View of Hargassner

Claims 1 and 9 stand rejected as allegedly unpatentable over U.S. Patent N. 5,797,444 to Villanueva et al. ("Villanueva") over Hargassner. In rejecting claims 1 and 9, the Examiner alleges that Villanueva teaches every element of claim of claim 1 except for providing 5-40% more heat flow in more stressed area of the bath. (See Office Action at page 5, lines 11-13.) The Examiner looks to Hargassner for this feature. As explained in greater detail, Hargassner does not disclose or suggest "the mold surface in said cooling zone having a rate of heat flow 5-40% greater than that in the remainder of the surface of the casting die providing increased cooling rate in the critically stressed areas of the casting die." For at least this reason, it is respectfully submitted that claim 1 is patentable over Villanueva and Hargassner.

Claim 9 depends from claim 1 and is deemed patentable at least by the virtue of its dependence from claim 1, which as stated is patentable over the cited references. For this reason, additional reasons for patentability of claim 9 will not be proffered here.

Accordingly, Applicants respectfully request reconsideration and withdrawal of this rejection and submit that the claims are in condition for allowance.

4. Claims 1-5 and 9 are Patentable Over Stagge in View of Hargassner

Claims 1-5 and 9 stand rejected as allegedly unpatentable over WO 97/43063 to Stagge et al. ("Stagge") over Hargassner. In rejecting the claims, the Examiner alleges that Stagge teaches every element of claim of claim 1 except for providing 5-40% more heat flow in more stressed area of the bath. (See Office Action at page 7, lines 7-9). The Examiner looks to Hargassner for this feature. As explained in greater detail, Hargassner does not disclose or suggest "the mold surface in said cooling zone having a rate of heat flow 5-40% greater than that in the remainder of the surface of the casting die providing increased cooling rate in the critically stressed areas of the casting die." For at least this reason, it is respectfully submitted that claim 1 is patentable over Stagge in view of Hargassner.

Claims 2-5 and 9 depend from claim 1 and are deemed patentable at least by the virtue of its dependence from claim 1, which as stated is patentable over the cited references. For this reason, additional reasons for patentability of claims 2-5 and 9 will not be proffered here.

Applicants respectfully request reconsideration and withdrawal of this rejection and submit that the claims are in condition for allowance.

5. Dependent Claims are Patentable Over the Art of Record

Each of claims 6-7, 12, 14 and 15 stands rejected as allegedly unpatentable over various combinations of Villanueva, Stagge, Hargassner, U.S. Patent No. 5,095,970 to Klein et al. and U.S. Patent No. 5,207,266 to Nakashima et al. Each of claims 6-7, 12, 14 and 15 depends from claim 1, either directly or indirectly. As discussed, claim 1 is deemed patentable over the art of record. Accordingly, each of claims 6-7, 12, 14 and 15 is deemed patentable at least by the virtue of its dependence from claim 1. For this reason, additional reasons for patentability of each of claims 6-7,

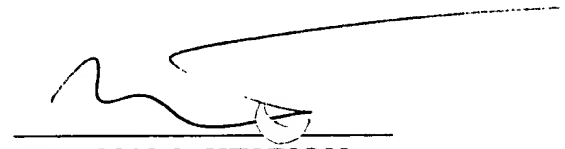
12, 14 and 15 will not be proffered here. Applicants respectfully request reconsideration and withdrawal of the obviousness rejection of claims 6-7, 12, 14 and 15 and submit that the claims are now in condition for allowance.

CONCLUSION

Applicants hereby request that the Office charge any appropriate extension of time fee which may be required to maintain the pendency of this case, and any other required fee, except for the Issue Fee, to Deposit Account No. 11-0600.

Respectfully submitted,

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MARKED-UP VERSION OF THE CLAIMS SHOWING CHANGES MADE

1. (Three Times Amended) A liquid-cooled casting die for a continuous billet casting comprising:

a form-giving casting die body, made of a material of high heat conductivity, having at least one broad side wall having at least one surface, a part of which defines a meniscus, the casting die body having a pouring side and a cooling-surface side, which cooling surface side is in contact with a bath

wherein the casting die body has a cooling zone in thermally and mechanically stressed areas of the die body, the mold surface in said cooling zone having a rate of heat flow 5-40% greater than that in the remainder of the surface of the casting die providing increased cooling rate in the critically stressed areas of the casting die.